Results from Russia

The Commencement of Blood Lead Testing in Kids

A binational collaboration to evaluate pediatric lead poisoning in Russia [*EHP* **110: 559–562**] has shown that although mean blood lead levels (BLLs) of the children studied were below U.S. guidelines, continued monitoring should still be done as Russia moves toward becoming more industrialized and thus, the potential for greater exposures increases.

Carol Rubin, chief of the Health Studies Branch at the Centers for Disease Control and Prevention's (CDC) National Center for Environmental Health, led the study of children in the Russian cities of Ekaterinburg, Volgograd, and Krasnouralsk. She and her colleagues chose the two former cities, each with a population of about 100,000, for their high industrial lead emissions and exhaust from vehicles using leaded gasoline. Smaller Krasnouralsk was chosen because it has a copper smelter that spews lead by-products into the atmosphere.

Blood samples were obtained using a new, portable, blood lead analysis instrument which requires only a fingerstick instead of vein puncture, making it more child-friendly. To assess the accuracy of the new device, the researchers retested the children's blood samples at the CDC lab and obtained comparable measurements. Blood samples were analyzed for 1,101 children 2–6 years old who were enrolled in preschools and kindergartens. Researchers also took environmental lead samples to find potential sources of exposure.

The study revealed a geometric mean BLL of 7.2 mg/dL. That's higher than the U.S. children's mean of 3.6 mg/dL, measured in the most recent survey, from 1988 to 1991, but lower than the 1976–1980 U.S. mean of 15.0. The Centers for Disease Control and Prevention (CDC) considers levels higher than 10 mg/dL excessive. Exposure among the three cities was highest in Krasnouralsk, where 60% of the children had excess levels. Researchers attributed their high levels to the smelter. Nineteen percent of the children in Volgograd and 11% in Ekaterinburg had levels above 10 mg/dL.

Environmental samples taken inside and outside the kindergartens and several children's homes suggest that Russian children are exposed to lead primarily from dust and soil. Researchers suspect the lead comes from industrial emissions and leaded gasoline. Although Russia is moving toward unleaded auto fuel, some cars still used leaded fuel at the time of the survey. Russians used very little heavily leaded paint due to its high cost, so their children are protected from what is a primary source of childhood exposure in the United States—lead in paint chips and dust.

According to the research report, Russian officials say that current industrial activity in Russia is far below capacity. When such activity increases, Russian children are likely to be exposed to greater environmental lead contamination, thereby meriting further monitoring of BLLs.—**Cynthia Washam**

A sticky situation. Monitoring of blood lead levels in Russian children finds good news but researchers recommend keeping a close watch.

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It Pays to Get the Lead Out

The Economics of Eradication

The public health benefits of the 90% reduction in human exposure to lead in the environment in the United States since the mid-1970s are clear. The great majority of children born today are virtually guaranteed to avoid the adverse health effects of exposure to lead, particularly the impairment of neurodevelopment, which can lead to reduced cognitive performance and undesirable behavioral outcomes. The economic benefits of this environmental success story may be less readily apparent, but they do exist. In this month's issue [*EHP* **110: 563–569**], Scott D. Grosse of the National Center for Environmental Health at the Centers for Disease Control and Prevention and his coauthors present the results of their groundbreaking model designed to quantify those economic gains. According to their calculations, based upon a wealth of previously published data, overall future earnings of children who were 2 years old in 2000 will increase between $110 billion and $318 billion, compared with their counterparts in the mid-1970s, as a result of their reduced exposure to lead in the environment.

Grosse and colleagues arrived at this extraordinary estimate through the use of a causal model linking blood lead levels (BLLs) to cognitive ability (as measured by IQ tests), which in turn influences individual lifetime earning potential and ultimately the economic gain realized by the entire group, in this case, the 3.8 million children who were 2 years old in 2000.

BLLs, as documented by the National Health and Nutrition Examination Survey (NHANES), have fallen dramatically from the mid-1970s to the present. Depending on which data points are compared from the early and recent NHANES studies, Grosse and colleagues arrived at a range of estimated decline, with a lower bound of 12.3 mg/dL and an upper bound of 15.1 mg/dL. Several studies in humans and animals have shown an association between BLLs and IQ levels, and to apply this factor to the calculation, the researchers assigned lower and upper values to the change represented by a reduction in BLL of 1 mg/dL, from 0.185 to 0.323 IQ points. The next step was to quantify the effect of IQ on potential earnings by an individual over the course of a lifetime, which must take into account both the direct effect of cognitive ability on earning potential and its indirect effects on schooling and employment. The range in this factor, again derived from several previously published studies, was determined have a lower bound of a 1.76% increase in earnings per 1-point difference in IQ, and an upper bound of 2.37%.

By multiplying those numbers by the present value of earnings of a 2-year-old ($723,000, in 2000 dollars) and then by the size of the cohort (the 3.8 million 2000 2-year-olds), they arrived at the bottom line—an economic gain of $110 billion to $318 billion for those children fortunate enough to be 2 years old in the year 2000, who will grow up in an environment in which they will face minimal exposure to the dangers of lead.

The authors conclude that their estimates may in fact be conservative, because their calculations did not take into account the economic value of avoiding other adverse health effects associated with exposure to lead. However, "the valuation of cognitive ability is sufficient to demonstrate the substantial magnitude of economic gains resulting from reducing the amount of lead in the environment to which people become exposed." The philosophical approach and the ingenious methodology employed in this study will no doubt serve as landmarks for future measurements of the economic impact of environmental hazards.—**Ernie Hood**

The Breast Milk Biomarker

Samples Provide Clues to Exposures

Since the early 1950s, environmental chemicals and their metabolites have been detected in human breast milk throughout the world. Research has focused primarily on organochlorine pesticides, polychlorinated biphenyls, and dioxins, while metals, solvents, and other chemicals have received scant attention. A few countries, notably Germany and Sweden, have ongoing breast-milk monitoring programs, but data from most countries come from small, scattered investigations. Taken as a whole, however, the data point to the pervasiveness of chemical exposure and hint at regional variations and trends over time. These data form the basis of the current review of chemical contaminants in breast milk by Gina Solomon, a senior scientist with the Natural Resources Defense Council in San Francisco, California, and Pilar Weiss, a graduate student researcher in the School of Public Health at the University of California, Berkeley. [*EHP* **110: A339–347**]

Because most studies were designed to stand alone, cross-study comparisons are challenging. The authors indicate that donor selection, sample processing, and other research methods vary considerably from one study to the next, as do the reported data. The greatest difficulty arises from inconsistent analyses, particularly for chemical classes with multiple members. For example, dioxins and furans include 17 chemical species, but only one dioxin, 2,3,7,8-TCDD, is nearly always measured.

Despite the challenges, Solomon and Weiss describe regional and time trends for several contaminants. Based on their review, the presence and concentrations of breast-milk contaminants are affected by global, regional, and local use of chemicals, and individual variability arises from age, diet, number of children, and duration of breastfeeding. Although local or regional use often predicts contaminant levels, some chemicals are detectable in breast milk even in its absence. As a case in point, studies in the mid-1980s showed measurable amounts of chlordane in breast milk samples from Finnish women although the chemical was never used in Finland and was heavily restricted in surrounding countries. The exposure was ultimately linked to consumption of fish from the Baltic Sea, a finding that also demonstrates that diet is a common route of exposure.

Solomon and Weiss's review indicates that levels of several contaminants, including chlordane, DDT, and hexachlorobenzene, have declined over time. These decreases are apparently linked to bans or restrictions on the use of those particular chemicals, and the only chemical class that appears to be increasing is polybrominated diphenyl ethers (PBDEs). However, the authors caution that these trends are based on incomplete data and only apply to the narrow sampling of chemicals for which breast milk has been tested.

The authors conclude that information gaps could be remedied by international breast milk monitoring programs using a standard methodology. Such programs would yield reliable data to demonstrate the scope of chemical exposure and to assess variations by location and population. These data could spur research into the health effects of detected chemicals, prompt action on limiting or eliminating exposure, and, over time, serve as a measure of pollution control success. However, such research needs to be sensitive to the importance of breastfeeding. Ample data demonstrate both short-term and long-term benefits to breastfeeding, note Solomon and Weiss, and any risk due to environmental contaminants in breast milk is overshadowed by these benefits.—**Julia R. Barrett**

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Breast is best. In addition to the benefits it provides to babies, breast milk also may be one of the best biomarkers of environmental exposure available.